

## PATENT SPECIFICATION

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## (54) PLUGS

(71) We, ITW-ATECO GMBH, a German Body Corporate, of Stormanstrasse 43-49, 2 Norderstedt 1 (Harksheide), Germany, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:-

This invention relates to methods of and apparatus for sealing holes in panels. It is particularly concerned with sealing varnish exit holes in the bodies of automotive vehicles.

For closing so-called varnish or paint exit holes in automotive vehicles, or for closing holes in housings of sheet metal or in plates or panels, plugs are used. The plugs have closed bottom walls, heads superimposing the margins of panels surrounding the holes, and annular collars joining the bottom walls to the heads. They are urged into the opening from the one side, seal them and are self-seating by virtue of their shape. The cup-shaped portions of the hole plugs, comprising bottom walls and adjacent annular collars, are urged into the openings to such an extent that the heads of the hole plugs abut the front margins of the openings.

Such plugs up to now generally could not be formed in such a way that they reliably protected the holes against the intrusion of water, so that at these sites there was the risk of rusting or intruding of water through the opening. Other plugs were formed in such a way that they did not stay reliably seated, but detached in vibrating conditions.

A plug of this type has also been proposed already which has a central bulged portion directed to the head in the bottom wall, and, for a further improvement, a conical configuration of the bottom wall surrounding the bulged portion. This plug can be made in a simple and economical way of a soft resilient material or plastic, and it can be inserted reliably and securely in an

opening when it is additionally provided at the outside with a projecting annular bead.

It has furthermore been proposed for increasing the sealing effect that the flange-like head is inclined slightly radially outwards towards the work panel, i.e. is formed conical so that it pressingly engages the surface of the work panel in resiliently deforming upon inserting the plug.

In some instances, however, such a plug does not fulfil the requirements regarding a reliable sealing against the intrusion of humidity of any sort.

According to the present invention, a method of sealing a hole in a panel, using a plug which has a closed bottom wall, a head which overlies the margin of the panel surrounding the hole, and an annular collar which joins the bottom wall to the head, includes the steps of placing between the head of the plug and the panel margin a film of a plastics material which is fuseable or adherable when heated, urging the plug into the hole, and heating the film to a temperature sufficiently high to melt it.

Such plastics film material for fusing and adhering is already known for other purposes, and it has the property of contracting over its entire surface, and in doing so effecting a compacting action when the film material is heated beyond a predetermined critical temperature without being caused to melt completely. If the fusing or adhering film is partially prevented, as in the instance described below, from shrinking, by a firm clamping, it merely melts at those locations where it is not clamped, and bonds the panel and the plug to one another. There it then causes a reliable sealing.

When the film is not excessively firmly clamped between the head and the panel, for instance because a comparatively thin head is selected and a relatively soft material has been chosen for the plug, a certain shrinking of the film is effected in the clamped portion which increases further the engaging pressure between the head and

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the panel, and thereby improves the seal.

The heating can be effected in various ways, for instance by hot air. In the example described below, the fusing and adhering of the film placed between the panel and the plug can be caused by the heat existing in the drying oven for the varnish. Also, a heating can be provided by heating the margins of the opening in the panel. Preferably it is proposed that the margins of the opening in the panel prior to inserting the hole plug and applying the film are preheated to a little in excess of the shrinking temperature. This can be done for instance by applying a heated die to the opening of the panel, or into it shortly before inserting the plug and a fusing or adhering film and is maintained in a good heat contact with the margins of the opening of the panel.

The fusing and adhering film does not need to be in the form of a ring between the head of the plug and the panel. Rather it is proposed for simplifying and rendering more economical the method that a closed, that is to say a continuous piece of fusing and adhering film is used. In this regard it will of course be ensured in all events that the film radially projects slightly all round, beyond the head of the plug i.e. has the shape thereof and is provided with a slightly larger diameter or a slightly larger outer dimension than it has. The use of a closed fusing and adhering film renders superfluous the previous stamping out of a hole in the film and thus renders more economical the method. Also closed fusing and adhering film pieces can be used for plugs of different diameters. The film can be applied smoothly on the panel opening, and in doing so it overlaps the margins thereof. The hole plug is then urged in, deforming and slightly stretching the film. Or the film piece can be placed beneath the bottom wall of the hole plug and inserted with it; this is useful when the margins of the panel have been preheated as described above.

The method of this invention can be practiced with various plugs, provided they have a collar closed by a closed bottom wall and a head for superimposing the margins of an aperture in a panel. According to another aspect of the invention, however, a particular plug is proposed having a closed bottom wall, a head and an annular collar which joins the bottom wall to the head, and an adhering film, the bottom wall of the plug being conically inverted towards the head, and having at its centre a bulged portion also inverted towards the head and an annular bead which projects outwards from the collar in the vicinity of the bottom wall, the adhering film being in the form of an annular disc, the inner diameter of which is larger than the outer diameter of the collar,

but which is smaller than the outer diameter of the annular head, and the outer diameter of which is larger than that of the head of the plug.

A plug constructed in accordance with this invention is described in detail below, by way of example, referring to the drawing. In the drawing:—

Figure 1 is a section of a plug with a fusing and adhering film;

Figure 2 is a section of the plug inserted in a work panel and the film of which has shrunk by the effect of heat; and

Figure 3 is a section of a plug with a closed fusing and adhering film associated therewith.

The hole plug illustrated in section in Figure 1 includes a conical inwardly-upwardly inclined bottom wall 4 having a likewise upwardly directed central bulged portion 5, an adjacent annular collar 1 and a flange-like head 3 adjacent thereto and extending downwards, inclined slightly. An annular bulge 2 projects outwards from the collar 1 in the vicinity of the bottom wall 4. An annular-disc like film 6 of a material which shrinks under the effect of heat and becomes adhesive, is associated with the hole plug.

In Figure 2 the plug is shown, inserted in a panel 7. For doing so the plug with the fusing and adhering film has been inserted in the opening of the panel 7 and its bottom wall 4 has been resiliently flexed upwards. A subsequent outward expansion of the annular bead 2 moves it over the margins of the opening of the work panel and securely retains the plug therein. At the same time the film 6 has been firmly urged against the rims of the opening of the panel in resiliently deforming the head 3. Finally the fusing and adhering film had been caused to melt by subjecting it to heat and thereby brought into the final shape 6' illustrated in Figure 2 in which the film sealingly bonds the facing surfaces of the panel 7 and of the head 3 of the plug to one another.

In Figure 3 the same hole plug having a head 3 and a bottom wall 4 is seen in the condition before it is inserted in an opening of a panel with a piece of continuous fusing and adhering film 6a. The film initially has a planar shape. Figure 3 shows the form which the film has at the beginning of the insertion into the opening. Finally, the outer annular portion of the film assumes the same shape as that seen in Figure 1, when surrounding the annular head and the bottom wall of the plug.

As regards the materials of the plug and film, the plug is preferably of a flexible plastic, for example nylon 11 or polyethylene, but could be of metal. The film can be of any plastics material which melts when heated, and is preferably a nylon

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(polyamide), or polyolefine-based plastic. It has been found that with some plastics films, pressure without heating has been sufficient to achieve the necessary bonding to the plug and the panel.

The adhesion of the film to the plug is a physical one, but when the film is fired with a painted panel there is a chemical reaction between the paint and the film.

10 WHAT WE CLAIM IS:—

1. A method of sealing a hole in a panel, using a plug which has a closed bottom wall, a head which overlies of the margin of the panel surrounding the hole, and an annular collar which joins the bottom wall to the head, the method including the steps of placing between the head of the plug and the panel margin a film of a plastics material which is fuseable or adherable when heated, urging the plug into the hole, and heating the film to a temperature sufficiently high to melt it.

2. A method according to claim 1 in which a coating of varnish or paint is first applied to the panel, the plug and film then being applied and the assembly heated to cure the paint or varnish, the heating being sufficient to melt and adhere the film.

3. A method according to claim 1 in which the margin of the hole is preheated beyond the film-adhering temperature before the plug is inserted.

4. A method according to any of claims 1 to 3 in which the piece of film is continuous.

5. A plug which has a closed bottom wall, a head and an annular collar which joins the bottom wall to the head and an adhering film, the bottom wall of the plug being conically inverted towards the head, and having at its centre a bulged portion also inverted towards the head and an annular bead which projects outwards from the collar in the vicinity of the bottom wall, the adhering film being in the form of an annular disc, the inner diameter of which is larger than the outer diameter of the collar, but which is smaller than the outer diameter of the annular bead, and the outer diameter of which is larger than that of the head of the plug.

6. A method of sealing a hole in a panel, substantially as described with reference to the accompanying drawing.

7. A plug and an adhering film substantially as described with reference to the accompanying drawing.

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1 SHEET *This drawing is a reproduction of  
the Original on a reduced scale*

Fig. 1

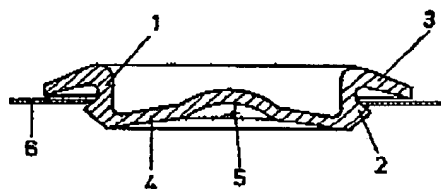


Fig. 2

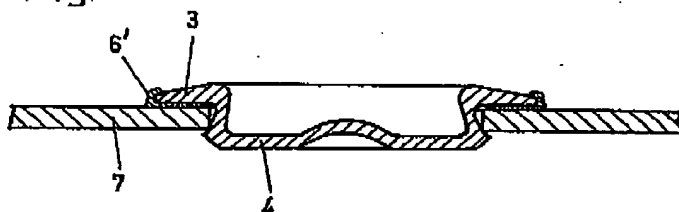


Fig. 3

